Ollscoil na hÉireann, Gaillimh
National University of Ireland, Galway

Summer Examinations, 2008/2009

Exam Code(s)	4IF
Exam(s)	B.Sc. Information Technology
Module Code(s)	CT420
Module(s)	Real Time Systems
Paper No.	1
Repeat Paper	no Special Paper
External Examiner(s)	Dr. John A. Keane
Internal Examiner(s)	Prof. Gerard Lyons
	Dr. Hugh Melvin

Instructions: Answer Q1 and **any other** 3 questions. All Q carry equal marks.

Duration	3 hrs
No. of Answer books	1

Requirements:

Handout	
MCQ	
Statistical Tables	
Graph Paper	
Log Graph Paper	
Other Material	

No. of Pages	4
Department(s)	Information Technology

Q1. (i) Distinguish using examples between a Hard and Soft RTS. Explain why many Hard RTS use a cyclic executive approach to scheduling whereas many Soft RTS utilise a RealTime Operating System.

(15)

(ii) Briefly compare and contrast the Cyclic Executive approach and Multiple Process approach to scheduling for Real Time Systems, commenting on where each might best be deployed.

(10)

(iii) As network administrator, you are asked to test/evaluate a range of new VoIP phones. Describe using diagrams how you might do this and what criteria you would use in your tests.

(15)

Q2. (i) Distinguish between **time and timing** synchronisation and explain using examples why both can be important for Real Time Systems.

(10)

(ii) Outline briefly at a high level how computer system clocks work. Compare and contrast using criteria such as operation, cost and quality the various options that a system designer has in terms of timing sources.

(15)

(iii) As a network administrator, you need to ensure that all servers within your Local Area Network are tightly synchronised to within +/-5 msec. Briefly sketch and describe your design for an NTP subnet to meet this requirement, commenting on all relevant issues (Stratum sources, redundancy, OS platform, network issues etc).

(10)

Show using an example how network asymmetry can seriously degrade NTP performance.

(5)

Q3. (i) Briefly outline the role of POSIX in Operating System design.

(10)

(ii) You are asked to develop a safety critical application that is required to run on a conventional Linux OS that supports many POSIX.4 features. Explain what POSIX.4 features you would use, how you would use them, commenting also on your choice of programming language.

(30)

Q4. (i) In context of delivering multimedia applications such as VoIP, distinguish between intrinsic and perceived Quality of Service (QoS), commenting also on role of subjective and objective methods of QoS evaluation.

(15)

(ii) As a LAN administrator, you have been asked to engineer your LAN to adequately deal with so-called triple-play services of Voice, Video and data delivery. What in your opinion are acceptable limits in terms of delay/loss for each of these services and explain how you might guarantee performance on your LAN.

(15)

(iii) Explain briefly the role of both Forward Error Correction FEC and Packet Loss Concealment PLC in dealing with packet loss for multimedia applications.

(10)

Q5. (i) Explain in detail how the Internet multimedia protocols RTP and its companion RTCP help to deal with the fundamental non-determinism of the public Internet and in particular on the challenge of implementing so-called lip-synch.

(25)

(ii) The design of jitter buffers is a key factor in delivering adequate QoS across non-deterministic packet networks. Discuss.

(15)

Q6. (i) You have been asked to design and implement an overall system architecture for a safety-critical air traffic control ATC system. Outline your approach which should deal with issues such as redundancy (both software and hardware), graceful degradation, and failsafe modes.

(20)

(ii) What are the main causes of RealTime Systems failure and outline how you would minimise risk of your ATC system failure.
(15)

(iii) In context of part 2 above, what do you understand by term second order ignorance 2OI. (5)